

## **BEN USER'S MANUAL**

Office of Enforcement  
United States Environmental Protection Agency  
401 M Street, S.W.  
Washington, D.C. 20460

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**THIS MANUAL IS RELEASABLE IN ITS ENTIRETY**

## **ACKNOWLEDGMENTS**

This document was prepared under the technical direction of Mr. Jonathan Libber, BEN/ABEL Coordinator, Office of Enforcement, U.S. Environmental Protection Agency (EPA), with additional input provided by Mr. David Hindin, Office of Enforcement, U.S. EPA. Technical assistance was provided to EPA by Industrial Economics, Incorporated (IEc) of Cambridge, Massachusetts under EPA Contract No. 68-W1-0009.

## REGISTRATION FORM

Would you like to be placed on the mailing list (Y/N)? \_\_\_\_\_

Would you like to obtain a PC version of the model (Y/N)? \_\_\_\_\_

Would you like to acquire a USER ID (Y/N)?\* \_\_\_\_\_

(If yes, to any of these questions, include your name and address below)

**NAME AND MAILING ADDRESS:**

**PHONE NUMBER:**

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( ) \_\_\_\_\_

Please mail to: Jonathan Libber, 2225  
U.S. Environmental Protection Agency  
401 M Street, S.W.  
Washington, D.C. 20460

\* Only government enforcement professionals may apply to EPA for USER ID's. Copies of the model and user manual are available to the general public through the National Technical Information Service (NTIS) at (703) 487-4630.

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**A. OVERVIEW**

The Environmental Protection Agency developed the BEN computer model to calculate the economic benefit a violator derives from delaying or avoiding compliance with environmental statutes. In general, the Agency uses the BEN computer model to assist its own staff in developing settlement penalty figures. While the primary purpose of the BEN model is to calculate the economic benefit of noncompliance, the model may also be used to calculate the after-tax net present value of certain supplemental environmental projects (SEPs).<sup>1</sup> This document, the BEN User's Manual, contains all the formulas that make up the BEN computer model and is freely available to the public upon request.

Calculating economic benefit using the BEN computer model is generally the first step in developing a civil penalty figure under the Agency's February 16, 1984, generic penalty policy (GM-21 and GM-22) and the related medium-specific policies developed since then to implement the 1984 Policy. The BEN computer model has been developed by the Agency to assist in fulfilling one of the main goals of the generic policy. That goal is to recover, at a minimum, the economic benefit from noncompliance to ensure that members of the regulated community have a strong economic incentive to comply with environmental laws on time.

In general, the BEN computer model is used for calculating economic benefit for purposes of developing a settlement penalty. The BEN model is generally not intended for use at trial or in an administrative hearing. If the Agency is going to present economic benefit testimony at trial or in an administrative hearing, the Agency will generally rely on an expert to provide an independent financial analysis of the economic benefit the firm has obtained as a result of its violations. This independent financial analysis, while consistent with the principles of

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<sup>1</sup> The PROJECT model calculates the after-tax net present value of most SEPs, but BEN is necessary for early-compliance SEPs.

the BEN model, may not necessarily be identical to that set forth in the BEN User's Manual.<sup>2</sup>

An outline of general penalty components and adjustment factors is shown in Exhibit 1-1 below. BEN is designed to calculate the first two categories of the "economic benefit component" listed in Exhibit 1-1: those gained from delaying or avoiding required environmental expenditures. Delayed costs can include capital investments in pollution control equipment, delayed costs to remove unpermitted dredged or fill material and restore wetlands, or one-time expenditures required to comply with environmental regulations (e.g., the cost of setting up a reporting system, or land purchases). Avoided costs include operating and maintenance costs or other recurring costs (e.g., off-site disposal of fluids from injection wells). BEN does not calculate the third category of benefits (i.e., those related to the competitive advantage gained by a violator).<sup>3</sup>

BEN can be used in all cases where there is a measurable benefit from delaying compliance, except for Clean Air Act Section 120 actions, which require the application of a Section 120 specific computer model. BEN is easy to use and has been designed for people with no background in economics, financial analysis, or computers. Because the program contains standard values for many of the variables needed to calculate the economic benefit, BEN can be run with only a small number of inputs. The program also provides the opportunity to use values other than the standard values. Exhibit 1-2 presents a listing of the inputs to BEN. The optional inputs listed in Exhibit 1-2 are those for which BEN has standard values.

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<sup>2</sup> For assistance with the selection of an expert on economic benefit, EPA staff should contact Jonathan Libber, the BEN/ABEL coordinator, at (202) 564-6011 or libber.jonathan@epamail.epa.gov.

<sup>3</sup> Competitive advantage benefits occur, for example, when a company earns a profit by selling its goods and services, possibly at prices lower than those of its complying competitors, before it obtains an EPA permit or after EPA has prohibited the sale of those goods and services.

**Exhibit 1-1**  
**CIVIL PENALTY POLICY SUMMARY**

**I. ECONOMIC BENEFIT COMPONENT**

- Benefit from delayed costs
- Benefit from avoided costs
- Benefit from competitive advantage

**II. GRAVITY COMPONENT**

- Actual or possible environmental harm
- Importance to regulatory scheme
- Size of violator
- Severity of violation(s)

**III. ADJUSTMENT FACTORS**

- Degree of willfulness and/or negligence
- Degree of cooperation/noncooperation
- History of noncompliance
- Ability to pay
- Other unique factors

BEN can be used to estimate economic benefit for many types of organizations: corporations, partnerships, sole proprietorships, not-for-profit organizations, municipalities, and so forth. There are two sets of standard values in BEN: one applies to for-profit business violators and the other applies to not-for-profit organizations. In either case, care must be taken in selecting input values other than the standard values. The BEN inputs listed in Exhibit 1-2 are discussed in detail in Chapter 4 for both for-profit and not-for-profit organizations.

**Exhibit 1-2**  
**INPUTS FOR BEN<sup>4</sup>**

**Required Inputs**

- 1) Case Name, Profit Status, and Filing Status
- 2) Capital Investment
- 3) One-Time Nondepreciable Expenditure
- 4) Annual Expenses
- 5) Date of Noncompliance
- 6) Date of Compliance
- 7) Date of Penalty Payment

**Optional Inputs<sup>5</sup>**

- 8) Useful Life of Pollution Control Equipment
- 9) Marginal Income Tax Rate for 1986 and Before
- 10) Marginal Income Tax Rate for 1987 to 1992
- 11) Marginal Income Tax Rate for 1993 and Beyond
- 12) Inflation Rate
- 13) Discount Rate

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<sup>4</sup> The previous version of BEN also contained a variable that allowed the user to enter low-interest financing, which was potentially appropriate under federal tax laws for violations beginning before and ending after 1986. Because this variable is rarely appropriate in current enforcement cases, it has been removed from the model. If you have a case where it may be appropriate (i.e., the violation spans January 1986 and the firm may have utilized low-interest financing), contact Jonathan Libber at (202) 564-6011 or [libber.jonathan@epamail.epa.gov](mailto:libber.jonathan@epamail.epa.gov).

<sup>5</sup> These are inputs for which Standard Values are available.

## **B. NATURE OF THE BENEFIT**

An organization's decision to comply with environmental regulations usually implies a commitment of financial resources; both initially (in the form of a capital investment or one-time expenditure) and over time (in the form of annual, continuing expenses).<sup>6</sup> These expenditures might result in better protection of public health or environmental quality; however, they are unlikely to yield any direct economic benefit (i.e., net gain) to the organization. If these financial resources were not used for compliance, they presumably would be invested in projects with an expected direct economic benefit to the organization. This concept of alternative investment -- that is, the amount the violator would normally expect to make by not investing in pollution control -- is the basis for calculating the economic benefit of noncompliance.

As part of the Civil Penalty Policy, the Agency uses its penalty authority to remove or neutralize the economic incentive to violate environmental regulations. In the absence of enforcement and appropriate penalties, it is usually in an organization's best economic interest to delay the commitment of funds for compliance with environmental regulations and to avoid certain other associated costs, such as operating and maintenance expenses.

The economic benefit from noncompliance might have any or all of the following three components: (1) the return a violator can earn by delaying the capital costs of pollution control equipment, (2) the return earned by delaying a one-time expenditure, and (3) the return a violator can earn by avoiding annual or one-time costs. The first two components arise because violators have the opportunity to invest their funds in projects other than those required to comply with environmental regulations. These other investments are normally expected to yield a monetary return at the violator's marginal rate of return on capital, whereas environmental expenditures typically yield no direct economic benefit. Thus, by delaying compliance, the violator benefits by the amount of earnings that could be expected from alternative investments.

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<sup>6</sup> Under the Clean Water Act §404 program, a decision to comply with regulations means delaying project start up until the U.S. Army Corps of Engineers issues a permit, which may contain mitigation requirements. BEN does not calculate the economic benefit from completing a development project sooner as a result of avoiding the Corps' permitting process, but the Agency may still choose to recapture this benefit. The Agency calculates the benefit from, for example, delaying the costs of mitigation requirements if the Corps issues an after-the-fact permit or delaying the restoration costs if no permit is issued.

The third component of the benefit from complying late is based on the annual continuing expenses that a violator would have incurred if the facility had complied with environmental regulations on time. These expenses include the costs of labor, raw materials, energy, lease payments and any other expenditures directly associated with the operation and maintenance of the pollution control equipment. Unlike capital and one-time expenditures, which are only postponed, annual expenditures can be avoided altogether. The resulting benefits to the violator are the total avoided annual costs as well as the return that could be expected on these avoided costs.<sup>7</sup>

When calculating the economic benefit of noncompliance, it is necessary to take into account indirect financial impacts associated with environmental expenditures. For example, one important indirect impact of these expenditures is a reduction in income tax liability.<sup>8</sup> Also, depending upon the tax year, the original purchase of equipment might have resulted in an investment tax credit. To account for these indirect tax effects, BEN calculates the economic benefit using after-tax cash flows.

Another indirect impact relates to the timing of the cash flows, since cash flows occurring in different years are not directly comparable. A basic concept of financial theory is "present value." This concept is based on the principle that: "A dollar today is worth more than a dollar a year from now," because today's dollar can be invested immediately to earn a return over the coming year. Therefore, the earlier a cost (or benefit) is incurred, the greater its economic impact. BEN accounts for this "time value of money" effect by reducing all estimated future cash flows to their "present value" equivalents. This widely-used technique is known as "discounting". Appendix A contains a more detailed discussion of discounting and the concept of present value.

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<sup>7</sup> On occasion, a violator may avoid a one-time expenditure or a capital expense as well, gaining the benefit of the avoided cost and the return earned on the avoided expenditure. These special cases are discussed in Appendix B.

<sup>8</sup> Depreciation and annual expenditures serve to reduce taxable income, thereby reducing income taxes.

## C. HOW TO USE THE MANUAL

This manual is designed to aid you in using the BEN model, either from the EPA LAN or from a PC diskette. Thus, this manual provides instructions for accessing, operating, and interpreting results from the BEN program. Specifically, Chapter 2 outlines the procedures for accessing BEN from EPA's LAN or from a PC diskette. Chapter 3 describes the structure of the program and discusses the procedures for entering data into the program. Chapter 4 defines each of the inputs you will need in order to calculate the economic benefit. Chapter 5 describes the results and output from BEN, and explains how to change input values for subsequent runs. Chapter 6 discusses a number of issues that often arise when running the program, such as how to obtain and characterize cost information.

This manual also contains three appendices. Appendix A contains a detailed discussion of the economic rationale and the computational methods used in calculating the economic benefit from delayed or avoided compliance. You do not have to be familiar with Appendix A to use BEN or this manual. Appendix B outlines the procedures for using BEN to calculate the economic benefit of noncompliance in special cases, such as cases involving avoided costs, delayed annual expenditures, or municipal grants. Refer to Appendix B if the economic events in your case do not exactly match BEN inputs. Appendix C describes the procedures for using BEN to calculate the after-tax value of a supplemental environmental project.

For users who are already familiar with the program, Exhibit 1-3 provides a printout illustrating the order and procedure for entering data. The inputs for the example are in **bold** print to distinguish user entries from the information and prompts provided by BEN. Help information is available in the program if you need the definition of a variable, sources of information, or the format required for an input entry. To access help for a specific variable, type **HELP** or **H** after the prompt for that variable. After the explanation, BEN will prompt you again for that same variable. If you need assistance in operating the program or understanding the results, please contact the U.S. EPA enforcement economics toll-free hotline at (888) ECON-SPT (326-6778) or [benabel@indecon.com](mailto:benabel@indecon.com). If you need legal or policy guidance, please contact Jonathan Libber, the BEN/ABEL Coordinator at (202) 564-6011, or [libber.jonathan@epamail.epa.gov](mailto:libber.jonathan@epamail.epa.gov).

Exhibit 1-3

DATA ENTRY FOR BEN

loading the program, please wait...

```
BBBBBBB  EEEEEEE  NNN    N
B        B  E      N NN   N
BBBBBBB  EEEEE   N  NN  N
B        B  E      N   NN N
BBBBBBB  EEEEEEE  N     NNN
```

Version 4.4. July, 1997.

```
*****
NOTE THAT ALL ENTRIES MUST BE TYPED IN UPPER CASE LETTERS.
*****
```

Would you like an introduction? (Y/N)

N

ENTER TODAY'S DATE (e.g., FEBRUARY 1, 1997)

JULY 1, 1997

1A. PLEASE ENTER THE CASE NAME:

ENTITY X EXAMPLE

**Exhibit 1-3**  
**DATA ENTRY FOR BEN**  
**(continued)**

1B. PLEASE ENTER THE PROFIT STATUS OF THIS ENTITY:

- 1 FOR-PROFIT (e.g., A BUSINESS)
- 2 NOT-FOR-PROFIT (e.g., A MUNICIPALITY)

PROFIT STATUS:

1

1C. PLEASE ENTER THE FILING STATUS OF THIS ENTITY. THIS WILL DETERMINE THE APPROPRIATE TAX RATE FOR THE VIOLATOR:

- 1 C-CORPORATION
- 2 OTHER THAN C-CORPORATION
- 3 SELECT FOR AN EXPLANATION

[NOTE: NOT ALL ENTITIES THAT HAVE "INCORPORATED" IN THEIR TITLES ARE C-CORPORATIONS.]

FILING STATUS:

1

2. INITIAL CAPITAL INVESTMENT IN POLLUTION CONTROL=  
(FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000 1996)  
(ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)

405000 1997

IS THE INITIAL INVESTMENT ONE-TIME OR RECURRING?

- 1. ONE-TIME
- 2. RECURRING

PLEASE ENTER THE APPROPRIATE CODE:

[NOTE: MOST CAPITAL COSTS FOR AIR AND WATER CASES ARE RECURRING]

2

3. ONE-TIME NONDEPRECIABLE EXPENDITURE =  
(FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000 1996)  
(ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)

210000 1997

IS THE ONE-TIME EXPENSE TAX-DEDUCTIBLE? (Y/N)

[NOTE: MOST EXPENSES ARE TAX-DEDUCTIBLE]

Y

**Exhibit 1-3**  
**DATA ENTRY FOR BEN**  
**(continued)**

4. ANNUAL EXPENSE =  
(FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000 1996)  
(ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)

**85750 1997**

5. MONTH AND YEAR WHEN NONCOMPLIANCE BEGAN (e.g., 1,1994)  
**2, 1994**

6. MONTH AND YEAR WHEN COMPLIANCE ACHIEVED (e.g., 1,1996)  
**8, 1997**

7. MONTH AND YEAR WHEN PENALTY PAID (e.g., 6,1997)  
**4, 1998**

BEN will use this information to calculate the economic benefit. If you select standard values for the remaining six variables, these standard values will be printed in your output. You also have the option of entering your own values for the remaining variables after Item 7.

BEN is ready to provide output. You have 4 choices:  
HOW DO YOU WISH TO TREAT REMAINING VARIABLES?  
(1 = USE STANDARD VALUES, 2 = ENTER OWN VALUES)

**2**  
YOU WILL NOW BE PROMPTED FOR VARIABLES 8 THROUGH 13

8. USEFUL LIFE OF POLLUTION CONTROL EQUIPMENT IN YEARS (e.g., 15) =  
**15**

9. MARGINAL INCOME TAX RATE FOR 1986 AND BEFORE (e.g., 49.6) =  
**49.6**

10. MARGINAL INCOME TAX RATE FOR 1987 TO 1992 (e.g., 38.6) =  
**38.6**

11. MARGINAL INCOME TAX RATE FOR 1993 AND BEYOND (e.g., 39.4) =  
**39.4**

12. ANNUAL INFLATION RATE (e.g., 1.8) =  
**1.8**

13. DISCOUNT RATE: WEIGHTED-AVERAGE COST OF CAPITAL (e.g., 10.6) =  
**10.6**

**A. INTRODUCTION**

BEN is an interactive computer program that resides on EPA's LAN. The program is also available to run on a stand-alone PC. The following sections describe how to run either version of the program.

**B. ACCESSING AND RUNNING BEN****1. Introduction**

The model can be obtained in one of four ways: 1) BEN is accessible via the internet at: <http://es.inel.gov/OECA/models/ben.html>, 2) Contact NTIS at (703) 487-4630, 3) Contact the U.S. EPA enforcement economics toll-free hotline at (888) ECON-SPT (326-6778) or [benabel@indecon.com](mailto:benabel@indecon.com), 4) Contact Jonathan Libber at (202) 564-6011, or [libber.jonathan@epamail.epa.gov](mailto:libber.jonathan@epamail.epa.gov). (Note that options (3) and (4) are available only to federal, state, and local government agents.)

**2. Running the Program****a. EPA LAN**

At the main menu, select the communications submenu. From there, select the **ALS Menu**. Then select the **Legal/Regulatory** option. Move the cursor to the line for **ABEL, BEN, CASHOUT** and **PROJECT**. Once in that submenu, select **BEN**. The model will then load.

**b. PC Version**

To run BEN, first insert the diskette containing the model into the computer. At the prompt **C:\>** type **A:** (or **B:** if the disk is in that drive) and press enter. At the prompt **A:\>** type **BEN**, press enter, and the model will load. If, however, the disk contains some of the other financial analysis models (such as ABEL, CASHOUT, and PROJECT) on other directories, before performing the last step you must type **CD BEN**. Then at the prompt **A:\BEN**, type **BEN** and press enter. The model will then load.

**Exhibit 1-4**  
**LOADING BEN**

```
C:\>      A:
A:\> CD BEN
A:\BEN>  BEN
```

This chapter provides information that is essential for using BEN effectively to calculate economic benefit. Section A describes how the computer program is structured, and provides an overview of the choices that BEN presents during program execution. Section B provides data format requirements and additional helpful hints for entering data at your computer terminal. This section also illustrates the error messages provided by BEN if you fail to enter data properly.

#### **A.     STRUCTURE OF THE PROGRAM**

BEN provides you with a number of choices for running the model. The first choice is whether to read an introduction to BEN. This introduction explains what BEN does, how it will prompt you for information, and the proper format for data inputs to the program.

A series of prompts for your input values follows the introductory question. You enter the requested information after each prompt. The economic benefit calculation involves a total of 13 variables, which are numbered 1 through 13. You must initially provide a name and some descriptive information for the penalty case. The values for variables 2 through 7 require information on the cost of compliance and the dates reflecting the period of noncompliance. BEN then gives you a choice between entering case-specific data for the remaining six variables, or using the standard values available in BEN. If you choose to enter case-specific values, the program automatically prompts you for variables 8 through 13. When you are finished entering data, BEN then calculates the economic benefit of noncompliance.

To access an explanation of the information required for a particular variable, simply type the word **HELP**, or the letter **H**, after the prompt for that variable. BEN will display a few sentences which define the variable, give sources of information, and provide a brief reminder of the format required. This information aids the user who has not read Chapters 3 and 4 of the user manual, or does not have access to a copy of the manual for reference during program operation. After the complete help explanation has been printed, BEN will prompt you again for the variable entry. You can then enter the required information.

When you have made all of your input selections, you can then choose from among three output options, each of which provides a different level of detail. No matter which output option you choose, BEN will include a list of the inputs used in the calculation as part of the output. BEN displays the results of your economic benefit calculation at your terminal and also temporarily saves the output in a computer file for printing. When you are finished with a calculation, you can choose to run the program again or end the program session. If you run the program again, you can change one or more of your entries from the previous run. You can then recalculate the economic benefit without having to reenter all variable values. The procedure for making changes depends on whether you used standard values in the previous calculation, and whether you plan to use standard values in the new calculation. These procedures are described in more detail in Chapter 5.

When you have finished performing economic benefit calculations and have ended the program session, BEN gives you the opportunity to order a printed copy of your output. Procedures for obtaining a printout are discussed in Chapter 2.

## **B. ENTERING THE DATA**

BEN is an interactive computer program. The terminal prints or displays a question and then waits for you to type an answer. Sometimes the prompt for information will be a description of the data to be entered instead of a question. In both cases, the cursor (or print head) returns to the beginning of the next line after printing each prompt.

Note that BEN is different from most PC software programs (such as Lotus 123 or Wordperfect) in that its user interaction is linear, as opposed to page oriented. This characteristic of BEN means that you cannot "back-up," or move around the screen, in order to edit an entry which you have already made.

### **1. Introduction**

Would you like an introduction? (Y/N)

You need only type **Y** to represent yes, or **N** to represent no. BEN will also recognize your answer if you type the full word for your response. If you answer **N**, BEN will skip the introduction and take you to the next step in the program.

The introduction contains four video-screen size pages. To aid PC users in reading the text, BEN stops scrolling at the end of each page. Press the carriage return (or **enter** key) to read the next page. The introduction screens read as follows:

This program calculates the economic benefit an entity gains by delaying expenditures necessary for compliance with environmental regulations or permits. This economic benefit is one component of a civil penalty.

The economic benefit calculation involves 13 variables. You must provide a name for the penalty case and respond to six prompts for information about compliance costs and the dates involved in the case. BEN then gives you a choice between providing values for the remaining six variables yourself or allowing BEN to use standard values.

BEN contains standard values according to the profit status and tax filing status of the entity. When you use BEN to calculate the economic benefit for a case, you will identify the type of entity involved, BEN can then select the appropriate set of standard values.

HIT ENTER FOR THE NEXT PAGE OF TEXT.

After each economic benefit calculation, you can change some or all of the values you provide and perform another calculation without leaving the program.

If you need additional information, call Jonathan Libber at:

202-564-6011

BEN allows only certain data formats for numerical values and dates: Numerical values (costs, rates, percentages, years) should be entered without commas, dollar signs, or percent signs. For example, enter a \$10,000 cost as 10000 and enter 20% as 20. Use decimals only for fractional values, such as 10000.50 dollars or 20.1 percent. Be careful to use only the number keys. A common mistake is typing the lowercase letter L instead of the number 1. Another error is typing the letter O instead of the number 0.

HIT ENTER FOR THE NEXT PAGE OF TEXT.

Dates entered for compliance and payment periods should be in numerical form, with the month separated from the year by a comma, as in: 6,1984. Note that the year must contain four digits.

Shown below is one example of a data prompt, and a response in the correct format. Notice that BEN gives you an example of the required format for data entry following the data prompt, enclosed in parentheses. Also note that the response (1,1991) begins at the left margin.

```
      5. MONTH AND YEAR WHEN NONCOMPLIANCE BEGAN (e.g., 1,1991)
1,1991
```

You can obtain help in entering any of variables 1 through 13 by typing HELP, or simply the letter H, after BEN prompts you for the variable. The help statements in BEN include a definition of the variable, possible sources for related information, and the format required for entry. After providing the HELP explanation, BEN will prompt you again for the same variable.

HIT ENTER FOR THE NEXT PAGE OF TEXT.

Before you enter any of the input values for your first calculation, you will enter today's date. BEN prints this date and the penalty case name at the top of the output for each calculation. This date may be entered in any format (e.g., Sept. 1, 1989; 9/1/89; 1 September 1989; and so on). The case name can be up to 40 characters long, including spaces.

You may leave the BEN program at any point during the input process. To do this, simply type "QUIT" (without quotation marks) in response to any prompt. BEN will warn you that quitting the program will mean losing all work done in that session (i.e., your output will not be printed), and will ask you if you are sure you want to "QUIT." Answering "Y" (yes), will terminate the program immediately, and take you back to the operating system.

Press the carriage return (or ENTER key) when you are ready to begin.

## 2. Format of the Data Entries

BEN data entries require specific data formats. Numerical values should be entered without commas, dollar signs, or percent signs. For example, a \$10,000 capital investment in pollution control equipment is entered as **10000**. The same is true for all other cost inputs. Each cost entry must include both the dollar amount and the year in which the dollars are expressed. Throughout this manual and in BEN itself, we refer to the year of the dollars in which an expenditure is expressed as the "dollar-year."<sup>9</sup> The dollar-year must contain four digits. If you do not enter a year, BEN assumes costs are expressed as of the compliance date. Rates or percentages should be entered as a number without a percent symbol, e.g., enter **20** to represent 20 percent. Decimal numbers need only be used where fractional values occur, such as 10000.50 dollars or 20.1 percent.

Be careful to use only number keys to enter numerical values. A common mistake is typing the lowercase letter **L** instead of a number **1**. Another error occurs when the letter **O** is typed instead of the number **0** (zero).

Dates entered for compliance and payment periods must be in numerical form, with the month separated from the year by a comma, e.g., **6,1989**. The year must contain four digits.

An example of the required format for data entry follows each data prompt, enclosed in parentheses. If the exact format is not followed, BEN prints an explanatory error message and then reprompts you for the correct entry. After your entry has been correctly typed, press the carriage return (or **enter** key) to transmit the data and signal to the computer that you are ready for the next prompt.

## 3. Correcting Typing Errors

After typing your entry you might discover that you have typed an incorrect letter or number. If you have not yet pressed the carriage return (or **enter** key), correcting the mistake is straightforward. Simply press the **backspace** key for each character that you wish to delete, and type in the correct information. If you are using the mainframe version, the cursor will not erase each character as you press the backspace key, and you will need to press the space bar to delete unwanted characters. If you are using a PC, the cursor will erase each figure as

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<sup>9</sup> In calculating the economic benefit, BEN converts all dollar inputs (initial capital investment, one-time expenditure, and annual expenses) into dollars of the year in which noncompliance began. This dollar-year conversion is necessary to make the costs comparable.

you press the backspace key, and your corrected entry will appear on the screen. Since you corrected the mistake before hitting the carriage return (or **enter** key), the terminal sends the corrected entry to the computer.

If you discover the error after you have pressed the carriage return (or **enter** key), the terminal will send the incorrect entry to the computer. If your entry contains an unacceptable character, BEN will print an error message and reprompt you for a corrected input. BEN will not detect an error if you simply enter an incorrect value. For instance, if you type **10244** instead of the intended value of **10234**, your calculation will be based on an erroneous input. In this case, you can only correct the error after you have entered all of the other variables (immediately before you run BEN). After you have completed your data entry, BEN will ask if you would like to review your inputs.

DO YOU WISH TO SEE A LISTING OF CURRENT VALUES? (Y/N)
<b>Y</b>

If you are unsure of an entry or want to correct a mistake, answer **Y**. BEN will show you the data you have entered and give you an opportunity to make changes. Type a **Y** to indicate you want to make a change. Then enter the number of the variables(s) you wish to change. After you have corrected all errors, type **0** for no change. See Chapter 5 for more information on changing input values.

#### 4. Error Messages

Occasionally, you might forget to follow the format rules when typing data entries, or you might select an option number that does not exist. In such instances, rather than continuing with the calculation, BEN temporarily interrupts the regular prompting sequence to print an error message alerting you to the mistake. After displaying the error message, BEN reprompts you for the correct information for that variable.

Error messages can be general or variable-specific. General messages apply to all prompts. Variable-specific errors occur for a particular variable when BEN checks for the correct relationships between variables, and for logical errors. Variable-specific messages are fully described in the case example which is covered in Chapter 4.

There are three general types of mistakes that generate error messages -- out-of-range input values, format errors, and illegal characters. BEN's error messages will help you locate the mistyped character, and allow you to re-enter the data before proceeding with your next input or beginning the calculation. Each of these error messages is described below. Examples from BEN sessions illustrate each error message and its related correction procedure. User entries are shown in bold-face print.

The error-checking mechanism will not recognize the types of errors caused by mistyping; for example, a **3** instead of a **2**, misspelling the case name, or entering the wrong date in response to the "today's date" prompt. Therefore, you should write down each input before running BEN, and then carefully check the typed data against each item on your written list. To do this, you can use the BEN Data Entry Form (see Exhibit 4-2).

**a. Unavailable or Out-of-Range**

The first type of error involves choosing an option that was either not presented (e.g., typing a number when a letter is required), or is not in the allowable range (e.g., entering a compliance date that is before 1971). In some cases, BEN prints a message telling you that your entry is not an available option for that input, and in others, it simply repeats the data prompt.

For example, the choice between printing an introduction to BEN or skipping over the introduction requires a yes (**Y**) or no (**N**) answer. In the following example, the user mistakenly typed **I** to indicate the first letter choice instead of simply typing the letter **Y** to signify yes.

```

      Would you like an introduction? (Y/N)
1
ERROR:   ENTRY  1  IS NOT AN AVAILABLE OPTION. ENTER AGAIN:
      Would you like an introduction? (Y/N)
Y

```

BEN recognizes the error, prints an error message that repeats the incorrect entry value, and reprompts the user for the correct information with the same question. The user then correctly typed **Y**, which is one of the available response options, and execution of the program continued as usual. The error message shown will appear whenever you type anything other than **Y** or **N** to the above question.

The following example illustrates a response which is out-of-range because the user asks to change Variable **14**, when in fact there are only 13 variables. The same error message appears.

```

      TYPE NUMBER OF VARIABLE TO BE CHANGED
      (TYPE 0 FOR NO CHANGE)

14

ERROR:   ENTRY  14  IS NOT AN AVAILABLE OPTION. ENTER AGAIN:

```

The next response is out-of-range because BEN will not accept a negative value for the initial capital investment. In cases such as this one, BEN simply repeats the prompt without printing an error message.

```

2. INITIAL CAPITAL INVESTMENT IN POLLUTION CONTROL =
  (FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000 1996)
  (ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)

-150000

2. INITIAL CAPITAL INVESTMENT IN POLLUTION CONTROL =
  (FOLLOW WITH DOLLAR-YEAR SEPARATED BY BLANK; e.g., 100000 1996)
  (ENTER 0 IF THIS COST CATEGORY IS NOT APPLICABLE)

```

A special out-of-range error message appears during the first calculation in a BEN session if you press

the carriage return (or **enter** key) without entering any data in response to a variable prompt.<sup>10</sup> BEN prints the following error message, and prompts you again for the variable:

```
ERROR:      YOU MUST ENTER A VALUE FOR THE FIRST
              CALCULATION.  TRY AGAIN.
```

#### **b. Format Error**

The second type of general error message involves a format error. After each data prompt, BEN provides an example of the format in which the data should be entered. These format examples are enclosed in parentheses. If you enter the data in an unacceptable format, an error message results. The user in the example below incorrectly typed commas in the cost input:

```
YOU HAVE ENTERED THE FOLLOWING: 100,000

ERROR:      NUMERICAL VALUES SHOULD BE INPUT
              WITHOUT COMMAS (e.g., 10000 TO REPRESENT 10,000).
              ENTER AGAIN.
```

In the next example, the user entered a slash (/) to separate the month from the year instead of the required comma.

```
YOU HAVE ENTERED THE FOLLOWING:  9/1989

ERROR:      MONTH SHOULD BE SEPARATED FROM YEAR
              BY A COMMA (e.g., 6, 1990).
              ENTER AGAIN.
```

#### **c. Illegal Character**

The third general error message indicates that you have entered an illegal character. In this case, you

---

<sup>10</sup> BEN allows you to press the carriage return without entering data in each subsequent BEN analysis. This means that the program will use the existing value in the next calculation. See Chapter 5 for further explanation.

have typed a character that does not belong to the same alphanumeric category as the rest of the entry. For example, typing **\$10000** as a cost entry generates the error message because a dollar sign is not an acceptable numerical digit. Similarly, typing **20%** to enter "20 percent" is not acceptable because **20%** contains the nonnumeric percent sign. A very common mistake is to type the lowercase letter L instead of the number 1 when entering numeric values. The related error message will repeat your entry to show your error as follows:

```
YOU HAVE ENTERED THE FOLLOWING:  120000
```

```
ERROR:      AN ILLEGAL CHARACTER EXISTS IN THE ABOVE ENTRY.  
            ENTER AGAIN.
```

Another common mistake is typing the letter O instead of the number 0 (zero) when entering numeric values. As in the above example, the incorrect entry is repeated with the error message before BEN reprompts for the correct information.

```
YOU HAVE ENTERED THE FOLLOWING:  120000
```

```
ERROR:      AN ILLEGAL CHARACTER EXISTS IN THE ABOVE ENTRY.  
            ENTER AGAIN.
```

The illegal character message occurs whenever the entry to any question contains a character that is nonnumeric in response to a prompt for a numeric value, including cases when a key might have been pressed by mistake, and a numeric entry contains an asterisk, bracket, quotation mark, or other non-alphanumeric symbol.